

# EXERCISES

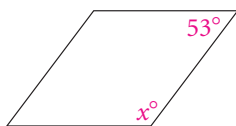
For more practice, see *Extra Practice*.

## Practice and Problem Solving

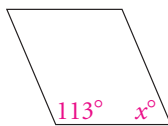
**A** Practice by Example  $x^2$  Algebra Find the value of  $x$  in each parallelogram.

**Example 1**  
(page 295)

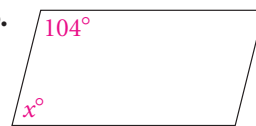
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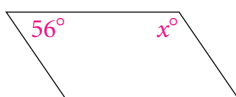
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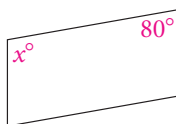
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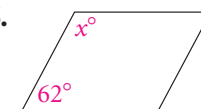
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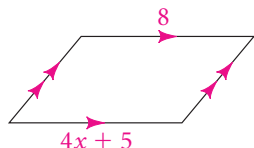


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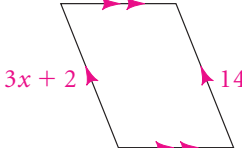


**Example 2**  $x^2$  Algebra Find the value of  $x$ .  
(page 295)

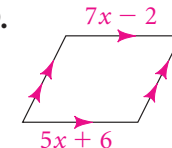
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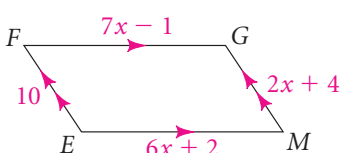


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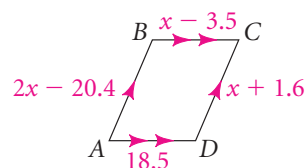


Find the value of  $x$  and the length of each side.

10.

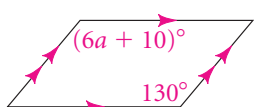


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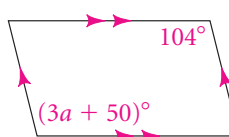


$x^2$  Algebra Find the value of  $a$ .

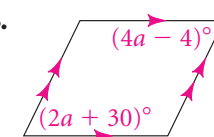
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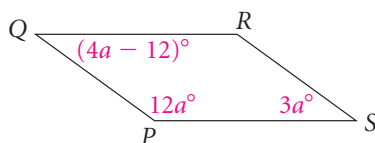


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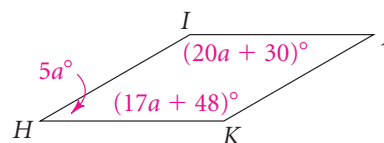


Find the value of  $a$  and the measure of each angle in each parallelogram.

15.



16.



**Example 3**  $x^2$  Algebra Find the values of  $x$  and  $y$  in  $\square PQRS$ .  
(page 296)

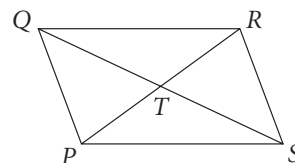
17.  $PT = 2x$ ,  $TR = y + 4$ ,  $QT = x + 2$ ,  $TS = y$

18.  $PT = x + 2$ ,  $TR = y$ ,  $QT = 2x$ ,  $TS = y + 3$

19.  $PT = y$ ,  $TR = x + 3$ ,  $QT = 2y$ ,  $TS = 3x - 1$

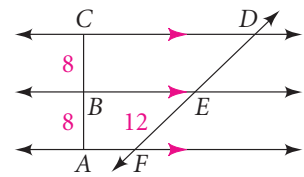
20.  $PT = 2x$ ,  $TR = y + 3$ ,  $QT = 3x$ ,  $TS = 2y$

21.  $PT = 8x$ ,  $TR = 6y$ ,  $QT = 2x + 2$ ,  $TS = 2y$



**Example 4**  
(page 297)

22. Find  $ED$  and  $FD$  in the figure at the right.



23. **Sewing** Suppose you don't have a ruler. Explain how to space four buttons equally on a shirt if you know where the first and last buttons must be placed and you have a large piece of lined paper.

In the figure, the horizontal lines are parallel and  $PQ = QR = RS$ . Find each length.

24.  $ZU$

25.  $XZ$

26.  $XU$

27.  $TZ$

28.  $TU$

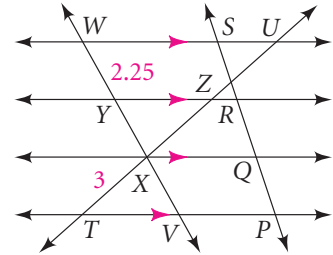
29.  $XV$

30.  $YX$

31.  $YV$

32.  $WX$

33.  $WV$



**B Apply Your Skills** **Algebra** Use the given information to find the lengths of all four sides of  $\square ABCD$ .

34. The perimeter is 48 in.  $AB$  is 5 in. less than  $BC$ .

35. The perimeter is 92 cm.  $AD$  is 7 cm more than twice  $AB$ .



**Need Help?**

Use the flow proof on p. 294.

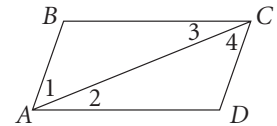


36. **Developing Proof** Complete this paragraph proof of Theorem 6-1 by filling in the blanks.

**Given:**  $\square ABCD$

**Prove:**  $\overline{AB} \cong \overline{CD}$  and  $\overline{BC} \cong \overline{DA}$

**Proof:**  $ABCD$  is a parallelogram, therefore  $\overline{AB} \parallel$  **a.**  $\underline{\hspace{1cm}}$  and  $\overline{BC} \parallel$  **b.**  $\underline{\hspace{1cm}}$ .  $\angle 1 \cong \angle 4$  and  $\angle 3 \cong \angle 2$ , because alternate interior angles are **c.**  $\underline{\hspace{1cm}}$ .  $\overline{AC} \cong \overline{AC}$  by the **d.**  $\underline{\hspace{1cm}}$  Property of Congruence. Therefore  $\triangle ABC \cong \triangle CDA$  by **e.**  $\underline{\hspace{1cm}}$ . So,  $\overline{AB} \cong \overline{CD}$  and  $\overline{BC} \cong \overline{DA}$  because **f.**  $\underline{\hspace{1cm}}$ .

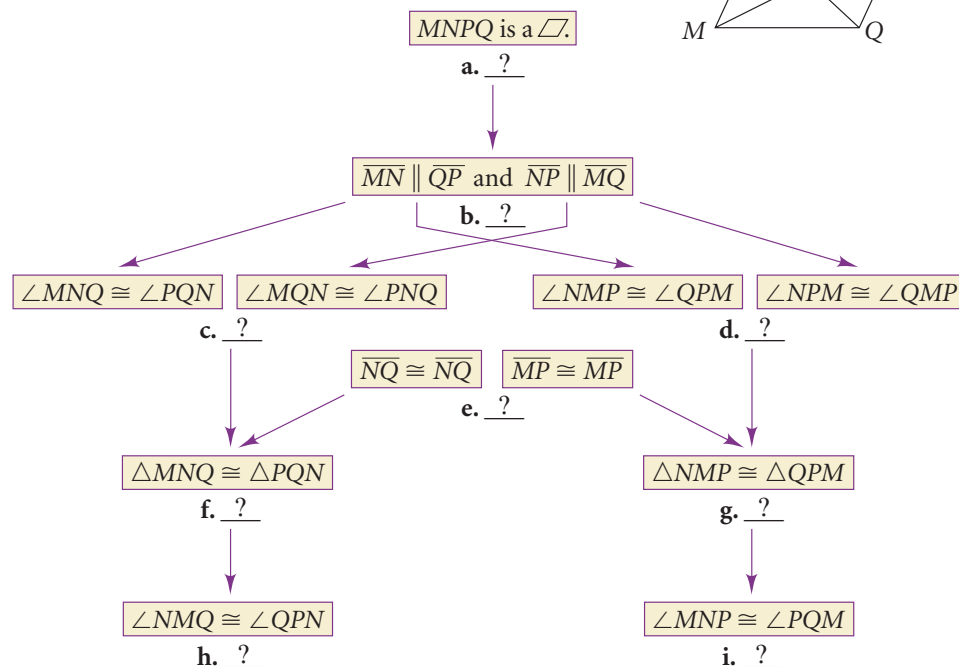
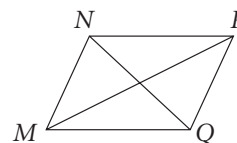


**Developing Proof** Exercises 37 and 38 ask you for two different flow proofs of Theorem 6-2.

37. Complete this flow proof of Theorem 6-2 by filling in the blanks.

**Given:**  $\square MNPQ$

**Prove:**  $\angle NMQ \cong \angle QPN$  and  $\angle MNP \cong \angle PQM$

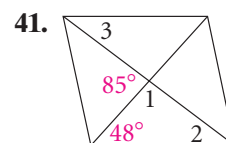
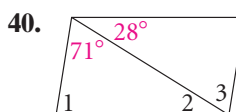
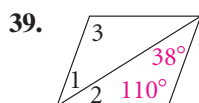


**Reading Math**

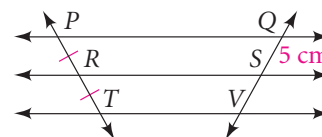
For help with reading and solving Exercise 38, see p. 302.

38. Write a flow proof for Theorem 6-2 that follows the plan on page 295.

**Find the measures of the numbered angles for each parallelogram.**

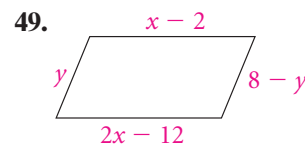
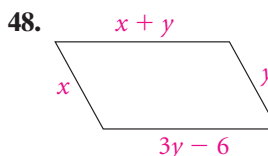
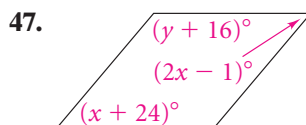
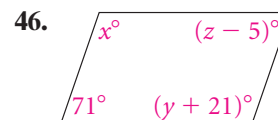
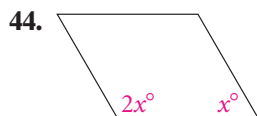


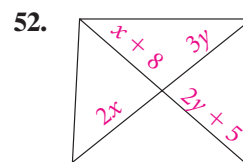
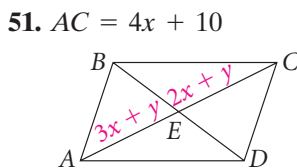
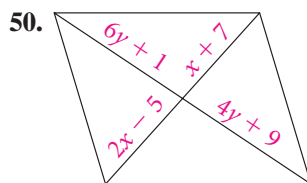
42. **Error Analysis** Brian states that  $QV = 10$  cm in the figure at the right. Explain why Brian's statement may not be correct.



$x^2$  43. **Algebra** In a parallelogram one angle is 9 times the size of another. Find the measures of the angles.

$x^2$  **Algebra** Find the value(s) of the variable(s) in each parallelogram.





53. **Writing** Explain how to find the measures of the remaining three angles of a parallelogram if you already know the measure of one of the angles.

54. a. **Open-Ended** Sketch two parallelograms whose corresponding sides are congruent but whose corresponding angles are not congruent.

b. **Critical Thinking** Is there an SSSS congruence theorem for parallelograms? Explain.

55. **Developing Proof** A proof of Theorem 6-4 is outlined below. Supply the reasons for each step.

**Given:**  $\overleftrightarrow{AB} \parallel \overleftrightarrow{CD} \parallel \overleftrightarrow{EF}$  and  $\overline{AC} \cong \overline{CE}$

**Prove:**  $\overline{BD} \cong \overline{DF}$

Draw lines through  $B$  and  $D$  parallel to  $\overleftrightarrow{AE}$  and intersecting  $\overleftrightarrow{CD}$  at  $G$  and  $\overleftrightarrow{EF}$  at  $H$ .

a.  $\overleftrightarrow{AB} \parallel \overleftrightarrow{CD} \parallel \overleftrightarrow{EF}$  and  $\overline{AC} \cong \overline{CE}$

b.  $ABGC$  and  $CDHE$  are parallelograms.

c.  $\overline{BG} \cong \overline{AC}$  and  $\overline{DH} \cong \overline{CE}$

d.  $\overline{BG} \cong \overline{DH}$

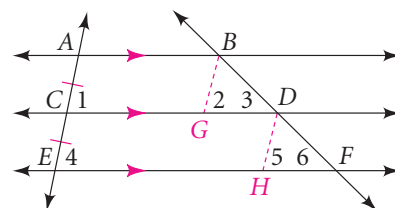
e.  $\overline{BG} \parallel \overline{DH}$

f.  $\angle 2 \cong \angle 1$ ,  $\angle 1 \cong \angle 4$ ,  $\angle 4 \cong \angle 5$ , and  $\angle 3 \cong \angle 6$

g.  $\angle 2 \cong \angle 5$

h.  $\triangle BGD \cong \triangle DHF$

i.  $\overline{BD} \cong \overline{DF}$



**Proof** Write a paragraph proof, a flow proof, or a two-column proof.

56. **Given:**  $\square LENS$  and  $\square NGTH$

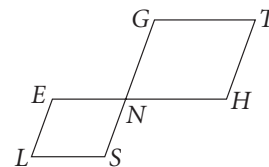
**Prove:**  $\angle L \cong \angle T$

57. **Given:**  $\square LENS$  and  $\square NGTH$

**Prove:**  $\overline{LS} \parallel \overline{GT}$

58. **Given:**  $\square LENS$  and  $\square NGTH$

**Prove:**  $\angle E$  is supplementary to  $\angle T$ .



### Need Help?

For each of Exercises 56–58, sketch the diagram and mark it as you think through a proof.



**Challenge Proof** Write a paragraph proof, a flow proof, or a two-column proof.

59. **Given:**  $\square RSTW$  and  $\square XYZZ$

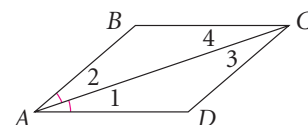
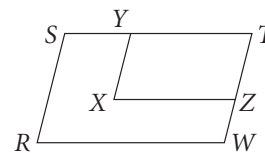
**Prove:**  $\angle R \cong \angle X$

60. **Given:**  $\square RSTW$  and  $\square XYZZ$

**Prove:**  $\overline{XY} \parallel \overline{RS}$

61. **Given:**  $\square ABCD$  and  $\overline{AC}$  bisects  $\angle DAB$ .

**Prove:**  $\overline{AC}$  bisects  $\angle DCB$ .



- Proof** 62. a. Prove that if two sides and the included angle of one parallelogram are congruent to corresponding parts of another parallelogram, then the parallelograms are congruent. (*Hint*: Prove that all the corresponding parts of the parallelograms are congruent.)  
 b. Is there a theorem similar to SAS for trapezoids? Explain.

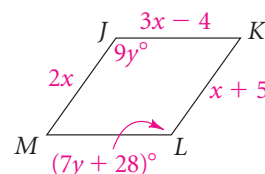


## Standardized Test Prep

### Gridded Response

Use the parallelogram at the right for Exercises 63–66.  
 Find the indicated segment length or angle measure.

63.  $JM$       64.  $ML$       65.  $m\angle L$       66.  $m\angle J$



67. The measures of three angles in a parallelogram measure 20, 160, and 20. Find the measure of the fourth angle.  
 68. The measures of two angles in a parallelogram are 32 and 32. Find the measure of one of the other two angles.  
 69. Two consecutive angles in a parallelogram have measures  $x + 5$  and  $4x - 10$ . Find the measure of the smaller angle.



### Take It to the NET

Online lesson quiz at  
[www.PHSchool.com](http://www.PHSchool.com)

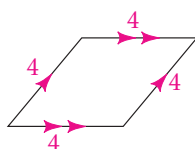
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## Mixed Review

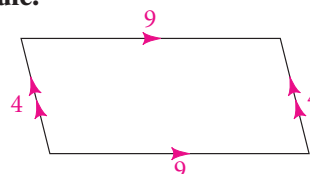
### Lesson 6-1

Determine the most precise name for each figure.

70.

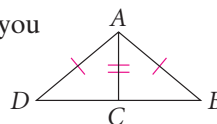


71.



### Lesson 4-6

72. What additional information do you need to prove  $\triangle ADC \cong \triangle ABC$  by the HL Theorem?



### Lesson 3-1

In the figure at the right,  $\overleftrightarrow{PQ} \parallel \overleftrightarrow{RS}$ . Find each measure.

73.  $m\angle 1$       74.  $m\angle 2$       75.  $m\angle 3$       76.  $m\angle 4$

